

February 11, 1963
#136-033

Dear Jack:

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As early as October 1961, we have discussed and quoted possible costs to prepare an "O" configuration for mission work in the research vehicle. Our recent conversation indicates there may possibly be some interest in this application for the near future. We have, therefore, taken a good look at the most economical and highest performance configuration design concept which could be used.

We would suggest the use of the Type IIC basic units for the proposed configuration. Through our testing program, we have become quite familiar with the parameters of the research vehicle and feel that satisfactory photography can be obtained by isolation only, rather than requiring an isolator-stabilizer system. Naturally, no thermal design consideration would have to be made in this application. We are able to operate satisfactorily within the pressure and temperature ranges which now exist in this research vehicle. We would, however, include as part of our proposal satisfactory filters in the air conditioning system to minimize oil vapor in the instrument bay.

A brief description of the necessary rework or design changes may be in order. A brief check on the basic theory of our sweep mirror and IMC cans indicates a more simple solution than now used in the Type IIC equipment. No data would be recorded other than the fixed data which includes mission number, unit identification and date plus a precision time record and principal point. Our concept, however, would permit the inclusion of a tape recorder for variable data in event that data might become available from the vehicle INS system. The control and drive electronic modules would consist of the sync or drive package, programmer, V/H drive circuitry and precision time generator. We would recommend the inclusion of an active V/H sensor and control system because our experience has shown that although the research vehicle is extremely stable, it has oscillatory flight patterns which should be corrected to attain optimum photography. We would still plan to use the 63° to 30° sweep from each side of the flight line by both A and B units to cover a total angular sweep of 126° perpendicular to that

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flight line. Resulting photography would, therefore, again provide 16° convergent stereo for all ground terrain $\pm 30^\circ$ from the flight line and complete overlap stereo of all areas between 30° and 63° from the flight line on each side of the vehicle.

To redesign the configuration for approximately 50% overlap would require basic film handling modifications. We suggest that the resulting multiple overlap will, however, be beneficial to the photo interpreter by insuring maximum definition cover. By adapting the Type IIC model in the suggested fashion, an image overlap of approximately 81% would result or from 4 to 5 images of each point on the ground would be recorded (all images would be in either convergent or overlap stereo and an optimum stereo match could readily be attained).

Approximating the vehicle V/H to be .010 milliradians per second, and with the 81% overlap indicated above, pertinent operational parameters would average:

Cycle Time	6.65 seconds
Sweep (Recording Time)	4.34 seconds
Reset and Rest Time	2.31 seconds
Total Photo Time Available	158 minutes (2.64 hrs.)
Total Flight Coverage	(1070 nautical miles)
(By redesign of the film path (not included in this proposal) we might be able to increase this coverage to 1350± nautical miles)	

The Type IIC drive system would be used as designed or, at the outside, would only require a worm-pinion gear train change.

Improvement in mirror coatings and the elimination of one mirror in the Type IIC system predict no problem in exposure time and should permit average exposures of 1/150 to 1/200 of a second using SO 132 material, a Wratten #25 filter and the Eastman Kodak J-241 lens. System performance is predicted to be in the 130 line per millimeter range providing a ground recording capability of approximately [REDACTED]

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A single high quality window approximately 22" x 23" will be used in the lower hatch.

System weight would be between 465 and 485 pounds. If required, the weight could be brought in at a slightly lower value. However, it is our understanding that the ship is trimmed for a certain instrument load and that weight would be added to maintain that load rather than permit a capability of a longer or higher flight.

If it was found necessary to minimize weight and accept less terrain cover, a single unit could also be mounted in the research vehicle. The unit could be oriented to record information approximately 45° on each side of the flight line or in its normal fashion to cover the area from 30° on either side of the flight line to 63° on the other by the 93° panoramic sweep. The single camera configuration would be mounted vertically and would only provide overlap stereo. Unless there is an urgent requirement to carry some other additional payload, it would be our recommendation that the normal, double unit configuration be used.

No inventions are necessary to supply the equipment suggested. It should be pointed out that drawings, parts lists, etc. do not exist for the described mission application. New layouts and structural designs would be required. The electrical and electronic control system would have to be integrated into an acceptable serviceable unit, rather than directed toward a test program as has been done in the past.

It is certain that a training program for operational personnel or other provisions for obtaining flight support should be considered.

If given approval immediately, the first unit could be delivered in approximately six months. A unit per month could follow after that time. To accomplish this type of delivery would require definitive release quantities on initial order. It is very difficult and uneconomical to schedule repetitive man hours through production and fabrication shops sequentially when they could be run in parallel. Although tooling requirements have been held to a minimum in the design program, machine set-up and checkout is a significant portion of the fabrication cost. Running quantities of components helps to reduce this overall cost.

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Another factor in immediate decision pertinent to program follow on is the availability of cleared, knowledgeable engineering personnel. As our design work on the Type IIC equipment is now nearing completion, design teams will be split up and men reassigned to other tasks. Our own engineering load is such that the camera group cannot be maintained on the premise that other configurations might follow. Considerable time and applicable skills could be lost by disbanding and then trying to reassemble the "O" project group.

25X1A A rough estimate of time and costs might be as follows. To supply design and engineering services and fabricate and test six Convergent Stereo units for research vehicle application would approach a total cost, including G & A and Fee, of approximately [REDACTED]. This would include the supplying of a V/H device within accuracy requirements, complete drawings and parts lists necessary to satisfy mission logistic support. The price does not, however, include operational personnel other than those required during the equipment acceptance period.

25X1A Spare parts requirements would be dependent upon method of handling logistic support. Spares for support of the equipment would run approximately [REDACTED] dependent upon centralization or duplication of the supply chain and should be procured simultaneously with the basic configurations.

As you appreciate, the above estimates are very preliminary and are based upon costs of current procurement equipment. Please also remember the figures could materially change over a period of time dependent upon engineering personnel availability and shop scheduling.

It should be brought to your attention that the units proposed for the research vehicle could be modified to be applicable in the "O" vehicle by factory retrofit in event the "I" program should be phased out in the future. This would require a new frame tie structure, new cams, the addition of thermal hardware and the incorporation of the isolator-stabilizer system for the "O" vehicle. The "O" electronic control system would also be added.

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We hope the above might serve as a basis for a decision on your part. All statements on price and delivery are based upon immediate acceptance. We would be pleased to discuss technical details and schedule at your convenience.

BLE:LB

Orig. + 4 cc: Jack T. w/ 2 enclosures (Sketch FL-137)







